"prickers" of the hussar to the old flint-lock musket. Putties, which Mr. Webb traces back to Anglo-Saxon times, are proved by recent discoveries to be as old as the Mycenæan culture.

Much, of course, still remains mysterious. Why has a man's coat its buttons on the right, that of a woman on the left? Is the cockade descended from the chaperon headdress of the time of Richard II.? Whence come the buttons on the jacket of the page and on the trousers of the costermonger? Can it be, as Mr. Webb suggests, that grooms weave straw in the manes of horses because the horse was once thought to be a corn-spirit? Such matters require for their solution a wider range of induction and a more scientific study of the evidence than is provided by the present book, which raises, if it fails to solve, many other curious problems of the same kind.

MODERN VIEWS OF ELECTRICITY.

Modern Views of Electricity. By Sir Oliver Lodge, F.R.S. Third edition, revised. Pp. xvi+518. (London: Macmillan and Co., Ltd., 1907.) Price 6*s.*

WHEN Sir Oliver Lodge decided to issue a new edition of his well-known treatise, he set himself a very difficult task. The first edition was published in 1888, the second in 1892; he might well have thought that the development of the science during the past fifteen years had been so rapid that nothing short of complete re-writing could render the book deserving of its title. However, he has concluded that, since recent progress has amplified our views of electricity rather than altered them, the treatise has not lost its value; that it is still an expression of the truth, though it may be only a partial expression. Accordingly the general plan of the third edition is the same as that of the first; the changes that have been made consist of a few minor alterations and omissions, together with the addition of six appended lectures.

The earlier editions are so familiar that no detailed comment is necessary. Electrostatic, conductive, and magnetic processes are described and illustrated by a series of mechanical analogies, leading up to the representation of the electromagnetic ether as a medium made up of elastically connected gear wheels, separated in some regions by surfaces of slip. In the elaboration of these analogies the author is seen at his best; everything that he writes is extremely suggestive, though some students may be puzzled by the inconsistency between the different illustrations that are used in different parts of the book to represent the same action. We would direct special attention to the admirable treatment of the magnetic effect of materials with a permeability greater than unity.

However, we think that the author has underrated somewhat the change in even the simpler parts of the work, which has been necessitated by recent discoveries. It is true that these discoveries have affected our views of the electric properties of matter rather than the properties of electricity itself, but all electrical experiments involve the use of material bodies. Thus the discovery of the great difference between positive and negative electricity invalidates Sir Oliver Lodge's representation of the magnetic field. He can no longer account for the negative result of Maxwell's attempt to find a finite angular momentum in a closed current circuit by the existence of two oppositely directed streams of positive and negative electricity; there must be a gyrostatic effect, though it is too small to be detected by any arrangement devised at present.

Again, our view of the effect of a material dielectric on electrostatic phenomena has changed completely. It is not believed now that the presence of sulphur alters the properties of the lines of force issuing from a neighbouring charged body; the effect of the sulphur on electrostatic actions should be represented in the same way as the effect of iron on magnetic actions. The view that all electric actions take place in the medium surrounding a charged body and not in the body itself has been modified; attention has been concentrated once more on the importance of the conception of a charge. It is misleading to speak of the dispersion of light as obscure and to suggest that it has no causal connection with selected absorption. The old view that a dielectric resists the passage of a current but may be "broken down" by a force sufficiently great suggests that a perfect vacuum devoid of all resisting matter should be a perfect conductor, and is utterly discordant with modern views. If the author did not see his way to re-write the book completely, we think that at least he should have added copious notes on these and many similar points to warn the student that the older statements must be revised in the light of later knowledge. As it stands, the book is of immense interest to those to whom modern conceptions are familiar, for it enables them to grasp at once the bearing of those conceptions on fundamental problems, but it would be dangerous in the early stages of reading.

We have detected one misprint on p. 224, l. 24: for "infinite" read "finite." We must also protest strongly against the use on p. 255 of the expression "centre of gravity of the ether" in place of "centre of mass." There is no evidence whatever that ether has a centre of gravity. N. R. C.

ENGLAND AN EXAMPLE FOR GERMANY.

Der naturwissenschaftliche Unterricht auf praktisch-heuristischer Grundlage. By Dr. F. Dannemann. Pp. xii+366. (Hanover and Leipzig: Hahnsche Buchhandlung, 1907.) Price 6 marks.

WE are accustomed in matters relating to school teaching to have German methods and results eulogised by contrast with our own, so that it is especially gratifying for once to find the tables turned. The author is a leading exponent of science teaching in his country, a schoolmaster of high repute in secondary schoolwork, and he has written this elaborate work frankly on the model of teaching that he witnessed at Harrow and other English secondary schools; and he has produced an account which in some respects is more thorough and comprehensive than anything we have in England. The only work to compare with it is the American book by Smith and Hall which appeared two years ago, and that deals only with chemistry and physics, while Dr. Danne-

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mann covers biology as well. One half of the work is taken up with detailed recommendations for class teaching in branches of natural science, viz. physics, chemistry, mineralogy, geology, astronomy, and biology, then chapters are added on the equipment of laboratories, the preparation and use of text-books, the training of science teachers, the treatment of scientific ideas in the order of their historical development; then some half-dozen appendices give documents taken partly from the regulations of the Kultus Ministerium in Prussia and in other German States, side by side with resolutions adopted by associations of science teachers, in which no doubt Dr. Dannemann is a leading personality.

The adoption of the term "praktisch-heuristisch" is sufficiently significant of the author's position. He does not give the history of the name "heuristic," and only incidentally refers to Prof. Armstrong, but in all his work he is definitely on the side of those who insist that the centre of a course of science teaching shall be at the bench in the laboratory, and that demonstration and discussion in the class-room must be associated with and take their cue from this centre of activity. He has nothing but scorn for the "Kreidephysik" which is still too commonly found in German schools, where the teacher with his chalk and blackboard demonstrates the truths of natural philosophy. It is very interesting to witness, from the pages of this work, how very reluctant German authorities are to adopt these reforms, and no doubt a strenuous advocate of English methods has not always a happy time among his countrymen. Indeed, the case is curiously paralleled by what is happening in England as regards modern language teaching. The "reformers" here look chiefly to Vietor and others in Germany for inspiration, and turn to many examples in German schools to show how a foreign language can be acquired. Dr. Dannemann tells his countrymen to look to the practical English teacher and to abandon their reliance on the parrot-like learning of scientific text-books.

Although much of the ground covered by these chapters will be familiar to the English teacher of science, there are portions which are novel, especially in the plans by which the author hopes to give a secondary schoolboy some grasp of the entire field of natural science before leaving school; and the sketch of science teaching from the genetic standpoint is also well worthy of careful perusal.

The chapter on the training of science teachers seems to us the weakest part of the book. It is difficult to see how university men can be kept for a year doing the very elementary work which Dr. Dannemann proposes for them; a man ought to have learned, during his university career in laboratories, to be able to secure himself and his scholars against accidents. But it is a little difficult to realise fully the conditions of German schools in these respects. We are sure from the quality of this and other writings by the author that any "Kandidat" who was sent to learn the business of a science teacher from him would gain a thorough understanding both of principles and practice.

WIRELESS TELEGRAPHY AND TELEPHONY.

Jahrbuch der drahtlosen Telegraphie und Telephonie. Band i., Heft i. Edited by Dr. G. Eichorn. (Leipzig: S. Hirzel, 1907.) Preis fur den Band, 20 marks.

Wireless Telephony in Theory and Practice. By E. Ruhmer. Translated by J. Erskine-Murray. Pp. xv+224. (London: Crosby Lockwood and Son, 1908.) Price 10*s.* 6*d.* net.

THE publication of the first number of a German year-book of wireless telegraphy and telephony affords an indication of the growing importance of this branch of electrotechnics. The volume before us is more of the character of an ordinary scientific magazine than of a year-book, since there is not really much attempt to summarise the progress during the past year, which, we take it, is peculiarly the function of a year-book. This objection apart, the publication deserves praise on account of the merit of the articles which it contains. Of these the most important are one by Prof. F. Braun on directed wireless telegraphy, one by Dr. Simon on the production of undamped waves, and one by Prof. Fleming on some of the most recent developments.

Dr. Simon's article will be read with special interest at the present time on account of the experimental work which is being carried on in all countries for the development of wireless telephony. In addition to these and some minor papers, there is a valuable bibliography.

The development of wireless telegraphy during the twenty years which have passed since the discoveries of Hertz has presented some peculiar features. Grown out of a discovery which, theoretically regarded, was of a sensational nature, wireless telegraphy has always seemed to have a tendency to sensational rather than solid progress. Except in so far as its military and naval value is concerned, the world at large cannot be said to have derived as yet any very great advantage from its development, and we doubt whether financial success, the touchstone of utility, has as yet rewarded any of the companies which have been pioneering the various systems. On the other hand, sensational performances, in which the hearts of all wireless workers appear to rejoice, have been frequent. The Marconi Company's first attempts to establish Transatlantic communication, the signal failure of their first commercial system of Transatlantic wireless telegraphy, and the apparent failure, so far, of their more recent attempt, will be fresh in the minds of all. As we have before pointed out in these columns, it would appear that the enormous efforts and expenditure which have been lavished on the development of long-distance signalling might have been much more usefully spent on the development of less ambitious but more solidly useful schemes.

More recently the attention to the production of undamped oscillations on the principle of the Duddell musical arc (as in the Poulsen system) has stimulated research on the wireless transmission of speech, and considerable success has attended the experiments. In Germany successful transmission across ten miles of land (right across Berlin) has been attained, and in America, in addition to the equipment of the torpedo-

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